UNITED STATES DEPARTMENT OF AGRICULTURE

BULLETIN No. 669

Contribution from the Bureau of Animal Industry
JOHN R. MOHLER, Chief

Washington, D. C. November 18, 1918

THE MANUFACTURE OF NEUFCHÂTEL AND CREAM CHEESE IN THE FACTORY

By

K. J. MATHESON and F. R. CAMMACK
Of the Dairy Division

CONTENTS

WASHINGTON
GOVERNMENT PRINTING OFFICE
1918

UNITED STATES DEPARTMENT OF AGRICULTURE

BULLETIN No. 669

Contribution from the Bureau of Animal Industry
JOHN R. MOHLER, Chief

Washington, D. C. | November 18, 1918

THE MANUFACTURE OF NEUFCHÂTEL AND CREAM CHEESE IN THE FACTORY.

By K. J. MATHESON and F. R. CAMMACK,

Of the Dairy Division.

CONTENTS.

IMPORTANT FACTORS IN SUCCESSFUL PRODUCTION.

When Neufchâtel and cream cheese are manufactured on a commercial scale it is important to use methods that will assure a uniform, attractive, and wholesome product. Very little detailed information dealing with the making of Neufchâtel cheese upon a factory scale is available. In fact, in many cases the trade secrets of this branch of the dairy industry have cost manufacturers large sums of money. In outlining the methods of making the cheese several factors should be taken into consideration:

1. Quality of raw material.
2. Healthfulness of the cheese.
3. Economical use of labor and equipment.
4. Reduction of losses to a minimum.
5. Conditions influencing the keeping quality of the cheese.

QUALITY OF MILK.

Formerly starters were not used in the making of Neufchâtel cheese on a commercial scale. Under such conditions a mixture of night's and morning's milk was deemed more desirable than fresh milk. With this system the normal fermentations were often superseded by gassy fermentations in warm weather and especially in the

spring months. This resulted in injury to the quality of the cheese and also greatly reduced the yield. At present practically all manufacturers pasteurize the milk, necessitating the use of a starter, but thereby preventing abnormal fermentations and insuring a uniform product from day to day. In either case, whether pasteurized or not, a sure and rapid development of the acidity is necessary in order to make the cheese successfully.

FACTORY SANITATION.

The room where the milk and cheese are handled should be constructed with a view of maintaining strict cleanliness. Cement walls and floors are almost imperative if they are to be kept in a sanitary condition by daily washing and flushing. The water used in the factory should be filtered or should be obtained from a source free from all possible contamination. The equipment and utensils in a soft-cheese factory should be so arranged and constructed as to be easily cleaned. Only such apparatus as is daily needed to facilitate the rapid and proper handling of the milk and cheese should be left in the workrooms. Precautions should be taken also to have all heating and cooling pipes below rather than above the place where the cheese is drained, so as to guard against falling particles of dirt and rust. All windows and doors of the factory should be provided with fine-meshed screens, to keep out flies and other insects.

THE MANUFACTURING PROCESS.

The process of making Neufchâtel and cream cheese in the factory is essentially the same as that on the farm, as described in Farmers' Bulletin 960. The handling of large quantities of milk, however, requires more elaborate and extensive equipment in order that the numerous operations may be performed rapidly and efficiently. Vats of about 600 gallons' capacity are commonly used for heating the milk. After a preliminary warming with the addition of rennet and a starter, the milk is run directly into shotgun cans holding about 4 gallons each, which are filled by means of a connecting pipe. The cans are then set side by side in a concrete-walled room, commonly known as a cellar, or, if the room is small, placed one upon another. Along the sides of the cellar are steam pipes that regulate the temperature so as to induce proper fermentation. After the milk has ripened for 15 to 18 hours the coagulum is poured upon draining cloths supported by means of special drain racks placed side by side. After a large part of the whey has drained off, the corners of the cloths are folded together, tucked in, and the resulting bags placed on ice in order to prepare the curd for pressing. After pressing, the curd is salted, ground by means of a roller or

other mixing device, and sent through a special molding machine which molds and cuts the cheese to the proper size. The cakes of cheese are then wrapped in tin foil or aluminum foil and boxed for shipment.

The details of the various steps of manufacturing are as follows:

PASTEURIZATION.

The principal reason for pasteurization in the making of soft, unripened cheese is to remove the danger from disease-producing organisms. In working with cheeses of the Neufchâtel group, Schroeder[1] found that of 32 samples of Neufchâtel cheese tested none were infected with tubercle bacilli; of 31 samples of cottage cheese tested 1 was infected with tubercle bacilli; of 131 samples of cream cheese tested 18 were infected with tubercle bacilli. In each case the tubercle bacilli found were of the bovine type. The desirability of pasteurizing milk for the making of such cheese is therefore evident.

If proper pasteurization is practiced, together with the use of an efficient starter, there are a number of other advantages, which may be enumerated as follows:

1. The cheese produced is more nearly uniform.
2. Gassy fermentations accompanied with excessive curd losses are prevented.
3. The yield is slightly increased.
4. Cheese of uniformly higher quality with less danger of bitterness when aged is insured.
5. Milk for making the cheese can be held for a longer time.

It is unquestionably true that cheese made from unpasteurized milk and without the use of a starter possesses a characteristic aroma at first not so readily observable in the pasteurized cheese, but the difference becomes less marked in the course of a few days. The initial aroma may be produced by some volatile substance that is partially driven off in the course of the pasteurization. To obtain a safe product, however, it seems desirable either to use milk from tuberculin-tested cows, or to pasteurize the milk and use a starter, even though the initial flavor is sacrificed to a slight extent.

Milk may be pasteurized by either the holding or the flash system of pasteurization, although the first mentioned is the better. Where new factories are being established, the holding system is always recommended. With the flash system the milk is heated to 165° or 170° F. for a moment and then cooled to the desired temperature. With the holding system the milk is heated to 145° F. and held at that temperature for 30 minutes. For small-scale operations the milk may be pasteurized by heating in a jacketed vat and cooled by water without being removed from the vat. For large operations the most economical kind of pasteurizer not only pasteurizes but cools and

[1] "Public Health Studies Concerning Cheese," a paper read before the International Association of Dairy and Milk Inspectors by E. C. Schroeder, at Washington, D. C., Oct. 17, 1917.

mixes the milk. From the standpoint of quality of the cheese there is practically no difference between the two processes; and in either case the milk, after pasteurization, should be cooled quickly to 80° F. for Neufchâtel or 83° F. for cream cheese. It is possible so to regulate the flow of brine or water in the coil as to bring the temperature of the milk to the desired point without rewarming.

STANDARDIZING THE MILK.

It is desirable to use whole milk testing 3½ to 4 per cent for making Neufchâtel, while for cream cheese sufficient cream should be added to the milk to bring the resulting mixture to from 6 to 8 per cent fat. In some factories the milk is skimmed and cream enough is added to obtain a 6 or 8 per cent milk. The milk always should be standardized before pasteurization.

With 4 per cent milk available, if one-third of the quantity is run through a cream separator and the resulting cream added to the remaining two-thirds, milk testing approximately 6 per cent is obtained. If the milk tests only 3 per cent it will be necessary to separate one-half of the quantity and add the cream to the remaining half. For extensive operations it is advisable to use a Babcock tester to standardize the milk accurately. The following diagram illustrates an easy method of determining the proportions of milk and cream of different per cent of fat needed to make up 6 per cent milk:

Cream and milk on hand.		*Proportions to be used.*
34 per cent cream.		2 parts cream.
	Six per cent milk desired.	
4 per cent milk.		28 parts milk.

The desired per cent of fat, in this case 6, is placed in the center of the square. At the upper left-hand corner the per cent of fat in the available cream is placed, in this instance 34. Immediately below, in the lower left-hand corner, the per cent of fat in the available milk is placed, which in the instance cited is 4. Next subtract diagonally across the square the smaller from the larger number and place the difference in the upper and lower right-hand corners respectively. In the upper right-hand corner 2 represents the number of parts of 34 per cent cream, and in the lower right-hand corner 28 represents the number of parts of 4 per cent milk necessary to make 6 per cent milk.

If it is desired to make up a definite quantity of 6 per cent milk, for example 60 pounds, the procedure is as follows: Two added to

28 makes a total of 30 parts of 6 per cent milk. The quantity of 34 per cent cream necessary is $\frac{2}{30} \times 60$, or 4 pounds, while the quantity of 4 per cent milk is $\frac{28}{30} \times 60$, or 56 pounds.

STARTERS.

A rapid development of acidity is necessary. The addition of commercial lactic starter aids in hastening subsequent drainage and checks objectionable fermentations. From 1 to 1½ per cent of starter is recommended for best results. The curd of the starter should be broken up into a fine condition before adding it to the milk. When pasteurization is practiced sufficient starter must always be added to make the development of acidity certain, and there is little danger of developing the acidity too rapidly. A slow-acting or impure starter is sure to cause disappointment and losses.

Too much attention can not be given to keeping the starter vigorous and pure. Satisfactory starters may usually be obtained from any reliable starter company. The method of handling the starter on a factory scale may be outlined as follows:

1. Place a clean agitator in a shotgun can that is bright, clean, and free from rust. (A 2-quart fruit jar and a long-handled spoon will be satisfactory for a small-scale operation.)
2. Put a quart of fresh skim milk in the can or jar and heat to 175° F. and hold at that temperature for 30 minutes.
3. Cool the milk to 75° F. and add the entire contents of a package of solid or liquid commercial starter, stir vigorously, cover, and set away until coagulation takes place.
4. Heat several gallons of skim milk in a starter can or in a 10-gallon milk can to 175° F. and hold at that temperature for 30 minutes, then cool to 75° F.
5. By means of an agitator break up the coagulum in the shotgun can into finely divided particles and then pour it into the starter can or 10-gallon milk can containing the pasteurized skim milk.
6. Each day repeat steps 4 and 5, but instead of preparing a fresh starter as in 1 and 2, use about 1 quart of the starter prepared the day before to each 10 gallons of pasteurized milk.

TEMPERATURE FOR SETTING.

The temperature at which milk is usually set to ripen is 80° F. for Neufchâtel and 83° F. for cream cheese. In certain factories the milk is set at 78° F. and the temperature is raised several degrees after coagulation has taken place. Experiments have demonstrated that temperatures from 75° to 85° F. for setting may be safely used. The object of the higher temperatures for setting is to favor a rapid coagulation, which in a measure reduces subsequent fat losses by quickly checking the rising cream. The temperature of setting de-

termines to a great extent the softness or firmness of the curd. Under normal conditions it requires from 45 to 60 minutes to curdle milk; the exact time to set a given lot of milk will, of course, depend upon the temperature, acidity, rennet, and composition of the milk.

RENNET OR PEPSIN.

Commercial liquid rennet, one-third of an ounce, or five-sixths of a gram of powdered pepsin, is added to each 1,000 pounds of milk. The rennet should be diluted in a half pail of cold water, or if pepsin is used, the powder is first dissolved in a little cold water and then handled in the same manner as rennet. There is some advantage, in the case of cream cheese, in using half an ounce of liquid rennet or 1 gram of powdered pepsin per 1,000 pounds of milk instead of the quantities specified. Sometimes powdered rennin is used as a curdling agent, in which case the quantity depends upon its strength. One gram of powdered rennin is usually equivalent to 4 or 5 grams of liquid rennet.

The powdered pepsin or powdered rennet should be weighed on an accurate balance and then dissolved in 20 times its weight of water warmed to 105° F. The solution is then poured through a strainer cloth into a dipper of cold water in order to remove any solid particles. Under no circumstances should powders be dissolved until needed for use. Pepsin has given nearly as satisfactory results as rennet and is less expensive.

All liquid curdling agents should be kept in a cold place in dark-brown bottles which are kept tightly corked.

FILLING THE CANS.

After being pasteurized and cooled down to 80° or 83° F. and the curdling agent added, the milk is drawn off from the faucets of the setting vats, which should be placed close to the cellar. The work must be conducted rapidly so that the contents of the vat may be removed within half an hour, to avoid agitating the milk after it has begun to set. Unless a sanitary connecting pipe is used in filling the shotgun cans it requires several workers to remove them as rapidly as they are filled. If not very carefully cleaned and thoroughly sterilized daily, the connecting pipe can not be kept in sanitary condition, and its use should be avoided. The shotgun cans are usually filled in the forenoon in order that the curd may be ready for drainage the following morning.

DUMPING THE CURD.

The following morning, if the fermentation or ripening has progressed satisfactorily, there should be about a quarter of an inch of whey, which is sufficient to form a scum on the surface of the curd. This is a fairly accurate sign of a proper fermentation, while

the absence of whey on the surface and a puffed appearance of the curd indicate either a poor starter or improper pasteurization.

Usually between 5 and 6 a. m. the cans of curd are poured upon the cotton-sheeting draining cloths which were spread over the racks the previous evening. In emptying the shotgun cans the contents are poured carefully against the side of the drain cloth rather than in the center, in order that any cream which may have risen may not be leached unnecessarily by the rapidly escaping whey. The contents of each can should be so poured as to break the jelly-like curd or coagulum as little as possible. No curd should be left adhering to the sides of the can. If the curd has a tendency to stick,

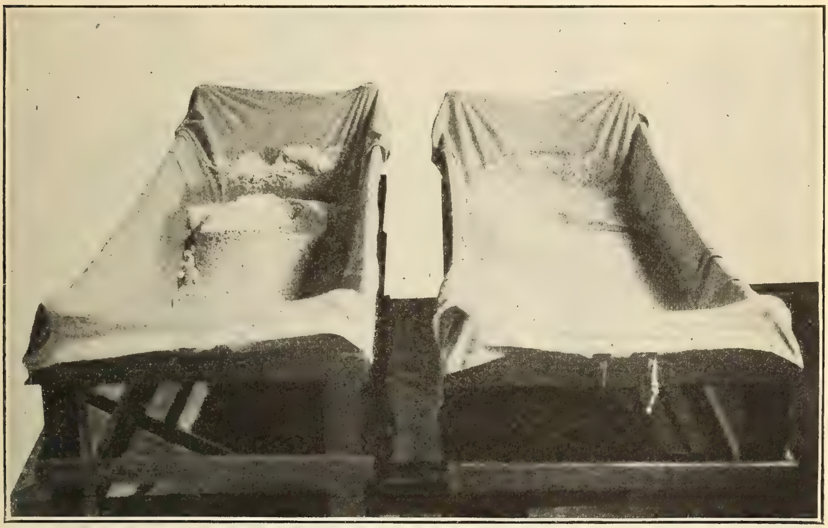

FIG. 1.—Gassy curd and normal curd.

which is more often the case when pasteurized milk has been used, it may be loosened by striking the can against the floor.

When emptied, the shotgun cans should be washed immediately, first in cold water and then scrubbed thoroughly in hot water containing washing powder, after which they should be rinsed again with warm water and thoroughly steamed.

The cans may be transported from the place of setting to the draining racks either by overhead trolley or by hand; in either case several men are needed to do the work promptly.

DRAINING.

The draining should be completed in about three hours, depending somewhat upon the kind of cheese, for cream-cheese curd drains much more slowly than partially skimmed Neufchâtel curd. A gassy curd drains much more rapidly than a normal curd, and the losses of curd are excessive.

For the first two hours the coagulum is left undisturbed, in order that the free whey may escape and that the curd may acquire a consistence that is not readily broken to pieces. Finely broken curd is unfavorable for drainage. During the last hour the curd is worked toward the center of the cloth by means of a tin or wooden ladle. The ends of each drain cloth are then loosened and the cloth and its contents placed in a boxlike rack which rests upon a wide, flat board, after which first the sides and then the ends of the cloth are alternately folded over the curd. The end pieces of the cloth are then tucked in, giving each drain cloth and contents a baglike appearance.

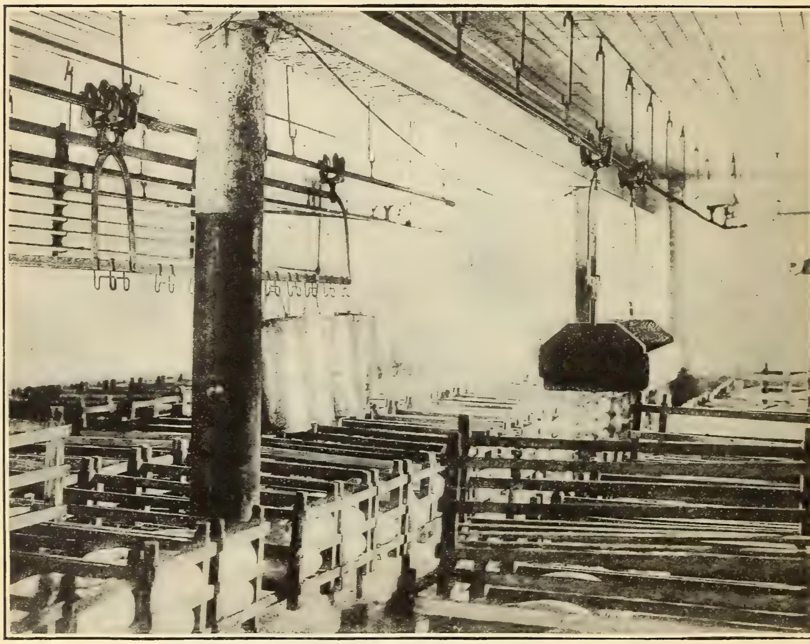

FIG. 2.—Draining equipment in a modern factory.

After the preliminary draining just described the manner of handling the curd in the bags will depend upon how soon they are to be pressed. If the cheese is to be pressed the same day the procedure is as follows: After draining for 30 minutes the bags are piled one upon another in a rack, where they remain for about half an hour, after which the bags from two racks are placed in a single pile. Usually two or three racks are placed one above another and the bottom sticks are removed. For about an hour the three or four dozen bags remain undisturbed, save for a rearrangement which occurs once during the period, when the position of the bags is reversed.

When the curd is not pressed until the following day, the bags of curd are placed on ice at once.

ICING.

When the cheese is made in large quantities, the bags of curd are always in alternate layers of cracked ice prior to pressing. Usually a large rectangular box about 3 feet high, 8 feet long, and 3 feet wide is provided in which alternate layers of ice and bags of curd are placed. Under the first system of draining, the curd may be cool enough in a few hours to permit pressing, while, if the pressing is not to be done until the following day, the bags are left on ice overnight. The object of chilling is to harden the curd so that it does not so readily pass into the meshes of the drain cloths and interfere with draining, and also to give it sufficient body to be molded.

PRESSING.

After chilling, the bags of curd are placed in a lever press provided with ratchet and pawl, where firm but increasing pressure is applied gradually, in order to allow the escape of whey and incorporated air. Without this precaution there is danger of applying so much pressure as to break the drain cloths, which is more liable to occur at first with a comparatively light pressure than later when more pressure is applied. The pressing should continue until a yield of 18 to 20 pounds per 100 pounds of milk is obtained for cream cheese and 14 to 16 pounds for Neufchâtel cheese. This is equivalent to a yield per bag (30-pound unit of milk) of 5½ to 6 pounds of cream cheese and 4½ pounds of Neufchâtel. The acidity of the whey at the beginning of pressing is about 0.50 to 0.55 per cent.

WORKING AND SALTING.

After pressing, the cakes of curd are salted and worked by machinery into a more or less buttery consistence. This is accomplished by either of two machines, namely, (1) a grinding machine consisting of a hopper and two grinding cylinders, which are rotated in opposite directions by power, and (2) a bread mixer or similar mixing device, which consists of a tilting mixing box provided with knives revolving in opposite directions, operated by electric power. Salt is sprinkled on the cakes of curd, usually at the rate of 1 pound of salt to 100 pounds of curd. Some manufacturers salt as high as 1½ pounds to 100 pounds of curd; the amount of salt to use will of course depend upon the trade demands. Either of the machines mentioned is used to distribute the salt uniformly throughout the curd; the rest of the work necessary for a cheese of smooth consistence is to be performed by the spiral screw of the molding machine. The mixer type gives the curd a very soft consistence, so much so that it must be kept at a low temperature for several hours or overnight before it will be in a fit condition for molding. On the other hand, the grinding machine is less vigorous in action and handles

the curd more rapidly. In this case, after coming from the machine, the curd is ready to mold at once.

The cheese, as it comes from either the mixing or the grinding machine, is transferred to the refrigerator or to the molding machine in large cans or square wooden boxes holding from 80 to 100 pounds.

MOLDING.

A special machine designed for molding may be purchased and is in use in most of the large soft-cheese establishments. The curd is placed in a hopper from which a spiral screw forces it into a molding tube that delivers it to an automatic cutting device, which cuts the curd to the desired lengths for wrapping. Operated by skilled work-

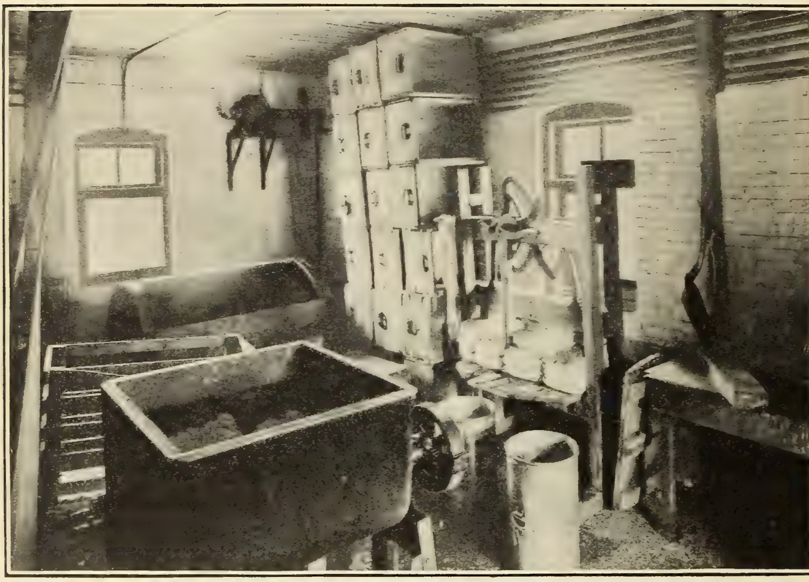

FIG. 3.—Curd mixer and press.

men with the curd in the proper condition, the machine can mold and cut from 2,400 to 2,500 Neufchâtel cheeses an hour, and cream cheese in like proportion.

Two conditions are necessary for the proper working of the machine: (1) The curd must have the proper temperature, about 50° F.; (2) the curd must not contain too much moisture. A yield of from 18 to 20 pounds of cheese per 100 pounds of milk seems most satisfactory. With a lower yield the cheese runs through with difficulty; with a higher yield it is often too mushy to handle satisfactorily. Only one person is actually required to operate the machine, although several are necessary for wrapping. The curd should be worked from the hopper into a feed screw by means of a ladle. The issuing roll or ribbon of cheese is automatically cut to the desired size and car-

ried by means of a canvas conveyer, which is about 10 inches wide and 12 feet long, to the place of wrapping. Along either side of the conveyer are seated girls who dexterously remove, wrap, and replace the cakes of cheese. At the end of the conveyer the wrapped cakes are removed by a girl who places them in suitable boxes.

Pimiento-cream, or pimiento-olive cream cheese is handled a little differently. The curd and pimiento peppers are first run through a meat chopper and are then ready to be sent through the molding machine. A cylindrical Neufchâtel attachment in the shape of a tube sufficiently small to pass to the bottom of a 4-ounce glass jar is used for filling purposes. The curd is forced into the jars until they are completely filled, when they are scraped over the end of the attachment so as to give a smooth appearance to the surface of the end and leave few if any air spaces throughout the curd mass. Sometimes the tops of the jars are leveled off by means of a milk cap.

FIG. 4.—Wrapping and packing Neufchâtel cheese as it comes from the molding machine.

METHODS OF PACKING.

The cakes of Neufchâtel and cream cheese are wrapped in tin or aluminum foil with parchment paper. The foil when purchased is cut to the proper size and stamped with the desired brand and weight. The commercial life of the cheese may be considerably lengthened by skillful and careful wrapping. Each wrapper should be drawn securely about the cheese before it is placed in the wooden box ("flat") in single layers, and each package should be well shaped and present a bright, attractive appearance.

Cream cheese is packed a dozen in each box, but the Neufchâtel cheese is marketed in boxes containing 1 or 2 dozen cakes, and sometimes 25, to the box.

Often the cheese is shipped in tubs or cans from the factory to the distributing center before molding. Such a system reduces labor

and freight charges to a minimum, and the keeping quality of the product is likewise improved.

The glass jars of pimiento or olive-cream cheese are first covered with paraffined disks of paper cut to the proper size and then with screw caps.

SIZE OF PACKAGES AND PRICES.

Standard Neufchâtel packages in tin foil are about 1½ inches in diameter and 2½ inches long, and weigh from 2½ to 3 ounces. At present they retail at about 7 cents a package, while the wholesale price is about $1.40 a box of 25 cheeses.

The cream-cheese packages in foil are 3 inches by 2 inches by 1 inch and weigh from 3 to 3½ ounces. Such packages retail at about 15 cents each; the wholesale price is from $1.30 to $1.40 a box of 12.

The pimiento cheeses, in glass jars, weigh 3½ ounces net and retail at about 15 cents a jar.

The size of packages has been fixed by experience. Larger packages have been tried by manufacturers, but the practice was quickly discarded as being impracticable. A small package of cheese may be consumed at a single meal, whereas larger packages would require special and effective refrigeration to prevent the development of mold and deterioration of flavor.

YIELD OF CHEESE PER HUNDRED POUNDS OF MILK.

The yield of Neufchâtel and cream cheese varies with the composition of the milk and the methods employed in making. One hundred pounds of milk containing 4 per cent fat yields from 14 to 16 pounds of Neufchâtel cheese, and milk containing from 6 to 8 per cent fat yields from 18 to 20 pounds of cream cheese. Higher yields sometimes are obtained, but cheese with a much higher yield is too soft to handle satisfactorily. Pasteurization ordinarily increases the yield from one-half to 1 pound per 100 pounds of milk. Usually when a lower yield is obtained the cheese is gummy and unattractive to the average buyer. If made from milk containing less butterfat correspondingly lower yields are obtained, as is the case when Neufchâtel cheese is made from partially skimmed milk, such as one-third, one-half, or even two-thirds skim.

EXPERIMENTAL WORK ON THE MANUFACTURING PROCESS.

Experiments were conducted to determine the most efficient methods to follow in the manufacture and subsequent handling of the Neufchâtel group of cheeses. The manufacturing phase of the work requires a consideration of the methods that will (1) reduce losses to a minimum, (2) insure a safe product, and (3) make the cheese most economically. The second phase of the work considers the

various factors which may influence the keeping qualities of the cheese. Very little previous work has been done along this line.

A study of each of the important steps has been found necessary to gather definite information with regard to the most efficient system of manufacturing, which includes a consideration of three factors: (1) Initial condition of curd; (2) rapidity of drainage; (3) fat losses. The following subjects have been considered:

1. Effect of different quantities of rennet.
2. The use of pepsin as a substitute for rennet.
3. Effect of temperature on the making process.
4. Effect of starter on the making process.
5. Effect of pasteurization and starters on the making process.
6. Effect of pasteurization on the moisture content of the cheese.
7. Effect of homogenization on the making process.

EFFECT OF DIFFERENT QUANTITIES OF RENNET.

A definite quantity of rennet is necessary in the manufacture of the Neufchâtel group of cheeses in order to obtain the characteristic curd, which must be neither too soft nor too brittle. The high cost of rennet requires that the curdling agent be used judiciously. So far nothing has been published regarding the most efficient and economical quantity of rennet to use for these cheeses. The quantity of rennet necessary depends not only upon the rate at which the whey is expelled, but also upon the breaking up of the curd and upon the fat losses caused thereby.

To determine this point, commercial liquid rennet in proportions varying from one-fourth of a cubic centimeter to 4 c. c. per 100 pounds of milk was used, with the results shown in Table 1. In each case 250 c. c. of lactic starter was added to each 30-pound unit of milk. Thirty pounds of milk was used in each of the experiments. All the whey was collected and measured from the time the coagulum was poured upon the draining cloths until the curd was in fit condition to ice, or in some cases for only part of that time. In any case the different parts of each sample were handled in the same manner. Fat determinations were made of each unit of a sample.

It is noticeable that the losses of fat increase with the higher percentages of fat in the milk, and there is also a slight increase in losses with the higher proportions of rennet. The losses of fat in the whey appear to be greatest when the large quantity of rennet causes the coagulum to be so brittle that it appears to break up more readily than when the lower proportion of rennet is used. Rennet in as small quantities as one-half of a cubic centimeter gave fairly satisfactory results with Neufchâtel cheese, though the curd of cream cheese appeared somewhat too moist. When 3 or 4 c. c. of rennet per

100 pounds was used, the curd was too dry to be satisfactory and the draining period was not shortened. There is a gradual increase in the whey expelled with the larger quantity of rennet until about 4 c. c. is used, when the drainage appears to be checked slightly.

Rennet used at the rate of from one-half to 2 c. c. per 100 pounds seems to be the most satisfactory for Neufchâtel cheese, whereas 1 c. c. to 2 c. c. seems most desirable for a like quantity of cream cheese.

TABLE 1.—*Effect of different quantities of rennet in the manufacture of Neufchâtel and cream cheese.*

Rennet per 100 pounds.	Neufchâtel.									Cream.					
	Sample 1. Set at 28° C. (82.4° F.). Fat, 3.6 per cent.			Sample 2. Set at 26° C. (78.8° F.). Fat, 3.1 per cent.			Sample 3. Set at 27° C. (80.6° F.). Fat, 4.33 per cent.			Sample 4. Set at 25° C. (77° F.). Fat, 6.3 per cent.			Sample 5. Set at 25° C. (77° F.). Fat, 7.2 per cent.		
	Fat loss.	Whey per unit.	Criticism of curd.	Fat loss.	Whey per unit.	Criticism of curd.	Fat loss.	Whey per unit.	Criticism of curd.	Fat loss.	Whey per unit.	Criticism of curd.	Fat loss.	Whey per unit.	Criticism of curd.
	Per ct.	*Grams.*		*Per ct.*	*Grams.*		*Per ct.*	*Grams.*		*Per ct.*	*Grams.*		*Per ct.*	*Grams.*	
$\frac{1}{4}$ c. c.		2,550	Too moist.												
$\frac{1}{2}$ c. c.		6,000	Good.	0.15	8,600	Good.				0.3	6,150	Too moist.	0.45	5,170	Too moist.
$\frac{3}{4}$ c. c.		7,400	Good.	.15	8,300	Good.		7,000	Good.						
1 c. c.		6,700	Good.	.15	7,920	Good.	0.25	6,650	Good.	.35	6,970	Good.	.35	5,580	Good.
2 c. c.				.15	9,620	Good.	.28	7,200	Good.	.35	7,070	Good.	.40	5,860	Good.
3 c. c.				.15	9,620	Too dry.	.30	7,300	Too dry.	.40	7,360	Too dry.	.45	6,720	Too dry.
4 c. c.				.15	8,720	Too dry.		7,000	Too dry.	.40	7,590	Too dry.			

PEPSIN AS A SUBSTITUTE FOR RENNET.

The scarcity of rennet has caused cheese manufacturers to look for a substitute. Table 2 shows the results of pepsin tests with cream cheese in quantities of one-sixth to one-twenty-fourth of a gram per 100 pounds of milk and fat determinations made of the whey.

TABLE 2.—*Effect of varying quantities of pepsin upon fat loss and condition of curd for cream cheese.*

Sample No.	Quantity of curdling agent per 100 pounds of milk.	Fat loss in whey.	Fat in milk.	Setting temperature.	Starter per unit of 30 pounds.	Criticism of curd.
		Per cent.	*Per cent.*			
1	Pepsin, 1/6 gram	0.18	5.8	27° C. (80.6° F.)	200 c. c.	Too dry.
	Pepsin, 1/8 gram	.14	5.8	do	do	Good.
	Pepsin, 1/12 gram	.14	5.8	do	do	Do.
	Pepsin, 1/16 gram	.15	5.8	do	do	Do.
	Pepsin, 1/24 gram	.14	5.8	do	do	Too moist.
	Rennet, 1 c. c.	.14	5.8	do	do	Good.
2	Pepsin, 1/6 gram	.08	5.9	29° C. (84.2° F.)	250 c. c.	Too dry.
	Pepsin, 1/8 gram	.10	5.9	do	do	Good.
	Pepsin, 1/12 gram	.08	5.9	do	do	Do.
	Pepsin, 1/24 gram	.10	5.9	do	do	Too moist.
	Rennet, 1 c. c.	.08	5.9	do	do	Good.

Pepsin used at the rate of about one-twelfth of a gram per 100 pounds gave the best results. With one-sixth of a gram for an equal quantity of milk the curd was too dry, while it was too moist when only one-twenty-fourth of a gram was used. The fat losses in the whey were practically the same for both the pepsin-made and the rennet-made cheese.

EFFECT OF TEMPERATURE ON THE MAKING PROCESS.

The literature about Neufchâtel and cream cheese shows different opinions relative to the temperature to use in their manufacture, the figures varying from 20° to 25° C. (68° to 77° F.). In our experiments to test this matter somewhat higher temperatures were found preferable. Temperatures ranging from 15° to 34½° C. (59° to 94.1° F.) were used. There was a degree or two of variation between the temperature of setting and that of pouring. The average temperature is given in the table. The method of making was the ordinary one previously described. The results are seen in Table 3.

It is noticeable that the losses of fat increase in the samples with the higher percentages of fat, and that the losses with the low-setting temperatures are somewhat high. A temperature below 25° C. (77° F.) or much above 30° C. (86° F.) did not prove desirable for the setting of either type of cheese.

TABLE 3.—*Effect of setting temperature upon loss of fat and the quantity of whey.*

Setting temperature.	Neufchâtel.									Cream.					
	Sample 1. Rennet, 1 c. c. per 100 pounds. Fat, 4 per cent.			Sample 2. Rennet, 1 c. c. per 100 pounds. Fat, 4.3 per cent.			Sample 3. Rennet, 1 c. c. per 100 pounds. Fat, 4 per cent.			Sample 4. Rennet, 1 c. c. per 100 pounds. Fat, 6.1 per cent.			Sample 5. Rennet, 1 c. c. per 100 pounds. Fat, 5.9 per cent.		
	Fat loss.	Whey per unit.[1]	Criticism of curd.	Fat loss.	Whey per unit.[1]	Criticism of curd.	Fat loss.	Whey per unit.[1]	Criticism of curd.	Fat loss.	Whey per unit.[1]	Criticism of curd.	Fat loss.	Whey per unit.[1]	Criticism of curd.
	Per ct.	*Grams.*		*Per ct.*	*Grams.*		*Per ct.*	*Grams.*		*Per ct.*	*Grams.*		*Per ct.*	*Grams.*	
15° C. (59° F.)	0.40	1,110	Too moist												
17½° C. (63.5° F.)				0.35	4,970	Too moist									
20° C. (68° F.)	.35	3,860	Too moist							0.40	7,560	Too moist			
20.5° C. (69° F.)													0.35	7,810	Moist.
21° C. (69.8° F.)							0.25	6,770	Little too moist.						
23.5° C. (74.3° F.)				.30	7,660	Moist									
25° C. (77° F.)							.20	8,250	Good	.35	7,200	Good			
25.5° C. (77.9° F.)	.20	6,320	Good										.35	8,320	Good.
26° C. (78.8° F.)				.25	8,010	Good									
28.5° C. (83.3° F.)							.20	9,030	Good						
29.5° C. (85.1° F.)										.35	8,560	Slightly dry.	.35	8,500	Slightly dry.
30° C. (86° F.)	.25	8,680	Good	.25	8,720	Good									
32° C. (89.6° F.)							.20	10,000	Too dry						
33.5° C. (92.3° F.)				.20	9,810	Too dry							.40	10,640	Too dry.
34° C. (93.2° F.)	.10	10,570	Too dry												
34.5° C. (94.1° F.)										.40	9,120	Too dry			

[1] Weight in grams was not carried to the last place.

EFFECT OF STARTER ON THE MAKING PROCESS.

Very little information is available as to how much starter may be safely added to ripen milk for making Neufchâtel cheese. When milk is pasteurized the need of carefully determining this point is obvious, for the desirable development of acidity must be assured or the cheese will be rendered unfit for sale. The effect of varying quantities of starter upon the fat loss in the whey is another point to be noted.

Samples of Neufchâtel and cream cheese were made without starter, while others contained from 1 to 1,250 c. c. of starter per 30-pound unit, as indicated in Table 4.

TABLE 4.—*Effect of starter on fat loss and drainage.*

Set at 25° C. (77° F.).							
Sample 1 (Neufchâtel). Rennet 1½ c. c. Fat 3.1 per cent.				Sample 2 (cream). Rennet 1½ c. c. Fat 6.3 per cent.			
Quantity of starter.	Fat loss.	Whey per unit.	Criticism of curd.	Quantity of starter.	Fat loss.	Whey per unit.	Criticism of curd.
	Per cent.	*Grams.*			*Per cent.*	*Grams.*	
1 c. c.	0.15	8,150	Good.	None	0.6	9,170	Off flavor.
10 c. c.	.15	8,160	Good.	10 c. c.	.35	5,880	Good.
250 c. c.	.15	9,170	Good.	50 c. c.	.30	7,020	Good.
				250 c. c.	.30	7,430	Good.
				1,250 c. c.	.35	8,490	Good.

Set at 28½° C. (83.3° F.).							
Sample 3 (Neufchâtel). Rennet ¾ c. c. Fat 3.8 per cent.				Sample 4 (cream). Rennet 1 c. c. Fat 5.6 per cent.			
Quantity of starter.	Fat loss.	Whey per unit.	Criticism of curd.	Quantity of starter.	Fat loss.	Whey per unit.	Criticism of curd.
	Per cent.	*Grams.*			*Per cent.*	*Grams.*	
None	0.6	9,060	Gassy.	None	1.1	10,180	Gassy.
10 c. c.	.06	8,150	Good.	10 c. c.	.10	7,810	Good.
50 c. c.	.06	8,620	Good.	50 c. c.	.10	9,060	Good.
250 c. c.	.07	8,830	Good.	250 c. c.	.10	8,150	Good.
1,250 c. c.	.19	8,380	Fair.	1,250 c. c.	.10	7,110	Fair.

The loss of fat shows the desirability of using starter instead of depending upon the normal fermentation, which may be gassy. Gassy fermentations are especially liable to occur in the spring months. Such fermentations may be sufficiently vigorous to cause the curd to run over the sides of the setting cans and often greatly reduce the yield of cheese, as well as lowering its quality.

Little difference was noted in the cheese made with varying quantities of starter. The use of heavy starter, as in case of samples 3 and 4, had a tendency to check drainage rather than encourage it. The same effect is caused by milk that has been ripened to a high degree before setting. As indicated in Table 4, there seems to be an advantage in setting the milk at 28½° C. (83.3° F.) and using rennet at the rate of 1 c. c. per 100 pounds rather than setting the milk at 25° C. (77° F.) and using 1½ c. c. of rennet for an equal quantity. There was very little difference in the flavor of the cheese made with different quantities of starter up to 250 c. c. per unit of 30 pounds.

EFFECT OF PASTEURIZATION.

The primary object in the pasteurization of milk for Neufchâtel and cream cheese is to render the resulting cheese safe from disease-producing organisms, and as a secondary object to reduce losses to a minimum. In addition, with the use of vigorous starter there should be little danger of a gassy fermentation after pasteurization. Several trials were made with pasteurized and nonpasteurized cheese to study their effects upon fat loss and drainage, as indicated in Table 5.

TABLE 5.—*Effect of pasteurization on fat losses and rate of drainage.*

Pasteurization temperature.	Neufchâtel.					
	Sample 1. Rennet ½ c. c. set at 25° C. (77° F.). Fat, 3.2 per cent.			Sample 2. Rennet ½ c. c. set 25° C. (77° F.). Fat, 4 per cent.		
	Fat loss.	Whey per unit.	Criticism of curd.	Fat loss.	Whey per unit.	Criticism of curd.
	Per cent.	*Grams.*		*Per cent.*	*Grams.*	
Not pasteurized	0.2	7,360	Good.	0.2	7,420	Good.
60° C. (140° F.)	.25	6,730	Good.	.2	6,720	Good.
65° C. (149° F.)	.25	6,900	Good.	.2	7,180	Good.
70° C. (158° F.)	.25	7,130	Good.	.2	6,830	Good.

Pasteurization temperature.	Cream.								
	Sample 3. Rennet ½ c. c. Set 25° C (77° F.). Fat 5.9 per cent.			Sample 4. Rennet ½ c. c. Set 25° C. (77° F.). Fat 6.3 per cent.			Sample 5. Rennet ½ c. c. Set 25° C. (77° F.). Fat 5.8 per cent.		
	Fat loss.	Whey per unit.	Criticism of curd.	Fat loss.	Whey per unit.	Criticism of curd.	Fat loss.	Whey per unit.	Criticism of curd.
	P. ct.	*Grams.*		*P. ct.*	*Grams.*		*P. ct.*	*Grams.*	
Not pasteurized	0.25	9,490	Good.	0.3	7,380	Good.	0.25	6,430	Good.
60° C. (140° F.)	.30	7,130	Good.	.3	5,940	Good.	.30	5,390	Good.
65° C. (149° F.)	.30	7,700	Good.	.3	6,000	Good.	.35	5,660	Good.
70° C. (158° F.)	.30	7,300	Good.	.35	6,680	Good.	.35	5,660	Good.

Comparatively little difference was found in the losses either with or without pasteurization, or with the different temperatures for pasteurization. These figures show that where milk is pasteurized for making Neufchâtel cheese the resulting curd tends to retain more of the whey. While theoretically the fat losses should be reduced somewhat by pasteurization because of the slowness with which the cream rises to the surface of the milk, yet the results fail to indicate any marked difference.

EFFECT OF PASTEURIZATION ON THE MOISTURE CONTENT OF THE CHEESE.

Pasteurization tends to give a higher percentage of water in Neufchâtel cheese than is the case in that made from raw milk. It appears that the pasteurized curd is more retentive, possibly because the curd particles are more finely divided than those from raw milk. When the pasteurized and the raw product are handled under the same conditions as far as we are able to control them, there is about 2½ per cent greater yield in moisture with the pasteurized cheese. Table 6 illustrates this point.

TABLE 6.—*Water in pasteurized and unpasteurized cream cheese.*

Sample No.	Not pasteurized.	Pasteurized.
	Per cent. moisture.	*Per cent. moisture.*
1	46.18	51.26
2	48.82	50.06
3	46.00	43.06
Average	47.00	49.46

These figures are from chemical analysis by Dr. J. N. Currie, formerly of the Dairy Division.

EFFECT OF HOMOGENIZATION ON THE MAKING PROCESS.

The cheese made from homogenized milk seems to "handle" very well, and the whey from the curd was remarkably clear. While it is possible that not all the fat is measured by the ordinary Babcock test, yet it is believed that such determinations give at least a very close approximation to the fat loss.

With cream cheese the fat losses are liable to be excessive. With the object of reducing these losses, milk was first standardized and then homogenized at a temperature of 43° C. (109.4° F.) and 2,000 pounds' pressure. The homogenized and unhomogenized samples of the same percentage of fat were taken from the same lots of milk. Cream cheese was then made in the usual way and the fat losses determined.

TABLE 7.—*Effect of homogenization on fat losses in cream cheese.*

Sample No.	Loss of fat.	Fat in milk.	Temperature of setting.	Quantity of starter per unit.	Rennet added per 100 pounds.	Criticism of curd.
	Per ct.	*Per ct.*		*C. c.*	*C. c.*	
1. Homogenized	0.015	6.2	30° C. (86° F.)	250	1	Good curd, whey very clear.
2. Homogenized	.020	6.2	....do	250	1	Do.
3. Homogenized	.020	6.2	....do	250	1	Do.
4. Homogenized	.025	6.2	....do	250	1	Do.
5. Homogenized	.015	6.2	....do	250	1	Do.
6. Not homogenized	.200	6.2	....do	250	1	Good curd.
7. Homogenized	.04	6.0	....do	250	1	Good curd, whey very clear.
8. Not homogenized	.150	6.0	....do	250	1	Good curd.

There is a slight advantage in homogenization in reducing the fat losses, but it is doubtful whether there is sufficient gain by this process to justify the added cost of such treatment.

EXPERIMENTAL WORK ON KEEPING QUALITIES OF THE CHEESE.

Neufchâtel and similar cheeses are very perishable products, the length of time that they can be kept depending upon the manner in which the cheese has been handled and the nature and quantity of the added ingredients. In the study of this problem the following points were considered:

1. Influence of yield on quality.
2. Influence of salt on keeping quality.
3. Influence of the holding system of pasteurization.
4. Effect of homogenization and of the flash and holding systems of pasteurization on keeping quality.
5. The use of powdered pepsin.
6. Influence of pimiento peppers.

INFLUENCE OF YIELD ON QUALITY.

In order to study the influence of yield upon quality, cream cheese was made in the customary manner, with the exception that some samples were pressed more than others. The samples were made to give yields varying from 15 to 24 pounds per 100 pounds of milk, and some were pasteurized, while others were not. The samples were kept at 10° C. (50° F.) and 20° C. (68° F.) and were judged by a number of persons at various intervals, with the results shown in Table 8.

In this and succeeding tests (Tables 9 to 13) the number of persons judging the cheese varied from time to time. This was unavoidable, as it was not practicable to have the same number each time.

TABLE 8.—*The effect of yield upon keeping quality of cream cheese in storage.*

[Samples held at 10° C. (50° F.).]

Sample 1.					Sample 2.						Sample 3.				
	Yield from 100 pounds of milk.					Yield from 100 pounds of milk, not pasteurized.						Yield from 100 pounds of milk.			
Age of cheese.	21 pounds, pasteurized.	18 pounds, pasteurized.	15 pounds, pasteurized.	18 pounds, not pasteurized.	Age of cheese.	24 pounds.	21 pounds.	18 pounds.	15 pounds.	No preference.	Age of cheese.	21 pounds, pasteurized.	18 pounds, pasteurized.	15 pounds, pasteurized.	18 pounds, not pasteurized.
Days.					*Days.*						*Days.*				
4	[1] 2	3	1	1	2	1	1	1	1	1	4	1	3	1	2
8	2	3	2	1	4	0	0	2	0	1	6	2	2	2	2
11	1	2	2	1	6	0	2	0	0	0	8	2	3	1	1
15	1	3	2	2	7	0	3	1	1	......	11	1	2	2	1
18	2	2	1	2	8	0	1	1	0	0	13	1	2	1	1
21	3	3	2	1	11	0	0	3	0	1	15	2	2	2	2
25	2	2	2	1	16	1	0	1	0	0	......	......	......	......	......
......	......	......	......	......	18	2	3	2	1	1	......	......	......	......	......

[1] The figures 1, 2, and 3 in body of table indicate the number of people expressing a preference for particular samples of cheese. In this and subsequent tests it was impracticable to have the same number of judges for each set of samples.

The samples that yielded highest appeared slightly more acid than the low-yield cheese, although the differences were not especially marked. The low-yield cheese seemed much more "gummy" and more quickly developed a Cheddarlike flavor after being kept several days. The majority of the judges preferred the cheese giving a yield of 18 pounds per 100 pounds of milk, while nearly as many preferred the cheese giving a yield of 21 pounds. With a yield of much more than 20 pounds per 100 pounds of milk, much difficulty will be experienced in running the curd through the molding machine. Because of that fact there is little danger of manufacturers making too moist a cheese.

INFLUENCE OF SALT ON KEEPING QUALITY.

In order to study the influence of salt in cheese upon its keeping quality, cream cheese was made in the usual way from milk testing 6.2 per cent fat, and portions were salted at the rate of $\frac{1}{4}$, $\frac{3}{4}$, $1\frac{1}{4}$, and $1\frac{1}{2}$ per cent. The cheese was wrapped in tin foil and held at 10° C. (50° F.) and 22° C. (71.6° F.) and examined at various periods. Table 9 gives the result of the experiment.

TABLE 9.—*Influence of salt on keeping quality of cream cheese.*

Age of cheese.	Held at 10° C. (50° F.)				Held at 22° C. (71.6° F.).			
	Per cent of salt.				Per cent of salt.			
	$\frac{1}{4}$	$\frac{3}{4}$	$1\frac{1}{4}$	$1\frac{1}{2}$	$\frac{1}{4}$	$\frac{3}{4}$	$1\frac{1}{4}$	$1\frac{1}{2}$
Days.								
3	[1] 0	5	3	3	0	3	3	5
6	0	3	3	1	0	2	3	2
8	0	1	4	0	0	0	5	0
11	0	2	3	1	0	1	4	0
15	0	1	2	0				
19	0	1	1	0				
24	0	1	2	0				
28	0	0	1	0				

[1] The figures in body of table indicate the number of people expressing a preference for a particular kind of cheese.

Most people seem to prefer a cheese containing from three-fourths to $1\frac{1}{2}$ per cent of salt. The cheese with one-fourth per cent salt was pronounced flat and insipid, while that with $1\frac{1}{2}$ per cent was usually considered too salty. The cheese with the one-fourth per cent salt spoiled more quickly than the other samples. When a few days old a slight bitterness developed in the cheese containing $1\frac{1}{2}$ per cent salt, while there was a distinct "off flavor" in the low-salted cheese. The cheese containing three-fourths and $1\frac{1}{4}$ per cent of salt seemed to keep equally well. In general the lower proportion of salt, about three-fourths to 1 per cent, is to be preferred, because a higher per cent has a tendency to hide the finer flavors of the cheese.

INFLUENCE OF THE HOLDING SYSTEM OF PASTEURIZATION.

To test the keeping qualities of pasteurized and unpasteurized cream cheeses, some experimental cheese was made at a commercial factory and sent to the laboratory of the Dairy Division. The cheese was shipped by express and upon arrival was placed in rooms maintained by an electric control at 20°, 15°, 10°, and 5° C. (68°, 59°, 50°, and 41° F.), respectively.

The initial heating of the milk was accomplished by running it through a pasteurizer where a temperature of about 62° C. (143.6° F.) was maintained for 35 minutes or longer. The milk was then run over cooling coils and cooled to the proper temperature for setting. One and one-half per cent of a vigorous starter was then added and the milk thoroughly stirred, after which the making process was carried on in the usual manner. The cheese was made from milk testing approximately 6 per cent fat. Samples were collected on successive days from the 200 or 300 pounds of experimental cheese.

The keeping qualities of the pasteurized and unpasteurized cheese held at various temperatures were determined by submitting samples of both, marked only by numbers, to individuals who recorded their preferences, as shown in Table 10.

TABLE 10.—*Keeping qualities of pasteurized and unpasteurized cream cheese in storage.*

Sample No.	Held at 20° C. (68° F.).				Held at 15° C. (59° F.).			Held at 10° C. (50° F.).			Held at 5° C. (41° F.).		
	Age of cheese.	Pasteurized.	Not pasteurized.	No preference.	Pasteurized.	Not pasteurized.	No preference.	Pasteurized.	Not pasteurized.	No preference.	Pasteurized.	Not pasteurized.	No preference.
	Days.												
1	5	[1] 8	4	1	6	6	1	9	4	0	9	4	0
	8	8	3	1	10	2	0						
	9	7	1	0	7	1	0	7	1	0	6	1	1
	12	4	1	2	4	1	2	6	1	0	6	1	0
	14	3	3	2	5	2	1	4	3	1	5	3	0
	16	3	6	0	5	3	1	2	6	1	7	2	0
2	5	6	2	0	5	2	1	5	2	1	5	2	1
	7	6	3	2	6	3	2						
	10	6	4	2	7	3	2	6	4	2	6	4	2
	12	0	2	1	1	1	1						
	14	0	3	2	4	1	0	2	2	1	3	2	0
3	4	4	2	1	4	1	2	3	1	3	4	1	2
	6	5	2	5	7	2	3						
	8	2	2	4	2	2	4	5	3	0	4	2	2
	10	5	2	2	8	0	1						
	12	1	5	3	1	3	5	2	3	4	4	4	1

[1] The figures in body of table indicate the number of persons expressing a preference for a certain kind of cheese.

The results seem to indicate that for about the first 10 days the preference was in favor of the pasteurized product for all temperatures. From 10 to 15 days the preference was for the pasteurized cheese held at 15° C. (59° F.) and 5° C. (41° F.) and for the unpasteurized cheese at 10° C. (50° F.) and 20° C. (68° F.).

In nearly every case the texture of the pasteurized product was judged superior to the unpasteurized. The difference may be partially accounted for by a small increase in water occasioned by the pasteurization.

EFFECT OF HOMOGENIZATION AND OF THE FLASH AND HOLDING SYSTEMS OF PASTEURIZATION ON KEEPING QUALITY.

To determine the most desirable system of handling milk prior to manufacturing it into cream cheese, so far as the keeping quality of the cheese is concerned, the following methods were studied:

1. Homogenization of the milk.
2. Flash system of pasteurization.
3. Holding system of pasteurization.
4. Check (where milk for cheese was neither homogenized nor pasteurized).

The samples of cheese compared were made from milk coming from the same vat, having therefore the same percentage of fat. When homogenization was practiced the milk was sent through the machine at 43° C. (109.4° F.) and with 2,000 pounds' pressure. Pasteurization by the flash system was carried on at 76.6° C. (170° F.).

In the holding system of pasteurization two temperatures were used, 62.8° C. (145° F.) and 76.6° C. (170° F.). The milk was heated to these temperatures, held for 30 minutes, and then cooled to the setting temperature.

The milk was manufactured into cheese in the customary manner and the samples judged at intervals, as indicated in Table 11.

TABLE 11.—*Effect of homogenization and the flash and holding systems of pasteurization upon cream cheese in storage.*

Sample 1, held at—							Sample 2, held at—						Sample 3, held at—					
	10° C. (50° F.).		15° C. (59° F.).		20° C. (68° F.).			10° C. (50° F.).						10° C. (50° F.).				
Age of cheese.	Not pasteurized.	Homogenized.	Not pasteurized.	Homogenized.	Not pasteurized.	Homogenized.	Age of cheese.	Homogenized.	Flash pasteurized at 76.6° C. (170° F.).	Hold pasteurized at 76.6° C. (170° F.).	Hold pasteurized at 62.8° C. (145° F.).	Not pasteurized.	Age of cheese.	Homogenized.	Flash pasteurized at 76.6° C. (170° F.).	Hold pasteurized at 76.6° C. (170° F.).	Hold pasteurized at 62.8° C. (145° F.).	Not pasteurized.
Ds.							*Days.*						*Days.*					
3	[1]17	0	7	0	7	0	3	1	2	3	2	1	3	2	1	2	2	0
5	7	0	7	0	7	0	4	1	1	3	2	1	5	1	2	2	2	0
7	3	0	3	0	3	0	6	1	1	3	2	1	8	1	1	2	2	1
10	4	0	4	0	4	0	7	0	1	2	1	1	11	1	1	2	2	1
13	3	0	3	0	0	0	8	0	0	1	1	0	......	.....	.....	.....	.....	.....
17	4	0	4	0	0	0	9	0	0	1	1	0	......	.....	.....	.....	.....	.....
21	2	0	2	0	0	0	10	0	0	1	1	1	......	.....	.....	.....	.....	.....
......	.....	.....	.....	.....	.....	.....	12	0	0	1	1	0	......	.....	.....	.....	.....	.....
......	.....	.....	.....	.....	.....	.....	15	0	0	1	1	0	......	.....	.....	.....	.....	.....

[1] The figures in body of table indicate the number of persons expressing a preference for a particular sample of cheese.

It may be noted that with the cheese from homogenized milk results were not the same for samples 1, 2, and 3. In sample 1 there was a peculiarly bitter, rancid flavor, which in most cases could be detected also in samples 2 and 3, but was much less in evidence. At other times Neufchâtel cheese made from homogenized milk testing about 4 per cent fat had such an extremely rancid flavor as to render it unfit for market purposes. It appears, therefore, that there is greater danger of developing this characteristic homogenized flavor with milk of low fat than with milk of high fat content.

The process of homogenization seems to be responsible for the bitter flavor observed in the cheese, for this bitter flavor is readily observed in the fresh cheese and does not develop further in storage.

The only justification for the use of homogenization is to reduce the fat loss to a minimum. The process, however, is practically unnecessary, because under normal conditions the fat losses may be reduced nearly as much in other ways and there is far less danger of developing a bitter flavor in the cheese.

There is very little difference apparently in the keeping qualities of cream cheese made from milk pasteurized by the flash system as compared with the holding system.

THE USE OF POWDERED PEPSIN.

Owing to the reduction of imports from Europe, rennet has risen to a very high price. Pepsin has been recommended as a substitute for rennet in the making of American cheese, but not for Swiss, Limburger, and other sweet-milk cheese. Experiments have been carried out with the different forms of pepsin in the manufacturing of cream cheese. The cheese was handled in the usual way and then placed at different temperatures, as indicated in Table 12.

TABLE 12.—*Comparison of use of rennet with powdered pepsin in manufacture of cream cheese held in storage.*

Sample 1. Held at 10° C. (50° F.).					Sample 2. Held at 20° C. (68° F.).					Sample 3. Held at 10° C. (50° F.).			Sample 4. Held at 20° C. (68° F.).			Sample 5. Held at 10° C. (50° F.).		
	Unpasteurized.		Pasteurized.			Unpasteurized.		Pasteurized.			Unpasteurized.			Unpasteurized.			Unpasteurized.	
Age of cheese.	Rennet.	Powdered pepsin.	Rennet.	Powdered pepsin.	Age of cheese.	Rennet.	Powdered pepsin.	Rennet.	Powdered pepsin.	Age of cheese.	Rennet.	Powdered pepsin.	Age of cheese.	Rennet.	Powdered pepsin.	Age of cheese.	Rennet.	Powdered pepsin.
Days					*Days.*					*Days.*			*Days*			*Days*		
4	[1] 4	3	4	3	4	3	4	4	3	3	4	3	3	3	4	4	6	
6	5	2	3	4	6	3	2	2	3	12	3	3	5	3	3	7	2	3
8	2	1	1	2	8	2	1	2	1	14	2	1	7	2	1	11	3	4
11	2	2	2	2	11	1	3	2	2	17	2	2	10	2	2	13	3	3
14	1	2	1	2	......	......	......	......	......	20	1	1	13	2	1	17	3	2
18	2	2	3	1	......	......	......	......	......	24	2	2	......	......	......	21	1	2
22	1	1	1	1	......	......	......	......	......	27	2	1	......	......	......	......	......	......

[1] The figures in body of table indicate the number of persons expressing a preference for a particular sample of cheese.

The results indicate that there is practically no difference in keeping qualities between cheese made from the powdered and that made from scale pepsin, or a difference so slight as to be negligible.

INFLUENCE OF PIMIENTO PEPPERS.

In order to study the influence of pimiento peppers upon the keeping qualities of pimiento-cream cheese, samples were made from milk testing 6 per cent fat and salted at the rate of 1 pound of salt to 100 pounds of curd. Varying quantities of the peppers were added to the cheese, which was placed in glass jars and capped, and samples kept at 5°, 10°, 15°, and 20° C. (41°, 50°, 59°, and 68° F.), respectively. Other samples were made at the same time without the peppers and placed at similar temperatures for comparison. The samples of cream and pimiento cheese were made from the same lot of milk where their keeping qualities are compared at a given temperature. Table 13 gives the result of the trials.

TABLE 13.—*Influence of pimiento peppers on the keeping qualities of cream cheese in storage.*

Sample No.	Age of cheese.	Held at 5° C. (41° F.).				Held at 15° C. (59° F.).			
		Pimiento 1/10.	Pimiento 1/20.	Pimiento 1/40.	Cream cheese.	Pimiento 1/10.	Pimiento 1/20.	Pimiento 1/40.	Cream cheese.
	Days.								
1	4	[1] 4	2	2	0	3	3	2	0
	6	9	8	0	0	9	8	0	0
	8	5	3	0	0	3	5	0	0
	13	5	2	2	0	4	3	2	0
	18	3	2	1	0	....	....	....	....
	28	3	0	1	0	....	....	....	....
	43	2	0	1	0	....	....	....	....
		Held at 10° C. (50° F.).				Held at 20° C. (68° F.).			
2	10	6	....	....	0	5	....	....	1
	17	3	....	....	0	2	....	....	1
	21	4	....	....	0	....	....	....	....
	27	3	....	....	0	....	....	....	....
	35	4	....	....	0	....	....	....	....

[1] The figures in body of table indicate number of people showing preference for particular samples.

A high percentage of pimientos seems to improve the keeping quality of the cheese kept at 5° C. (41° F.) and 10° C. (50° F.). When held at 10° C. (50° F.) the pimiento cheese kept in good condition for a month, at which time it was edible, although some acidity had developed. No undesirable flavor had developed as in the case of the plain cream cheese. Either the pimiento acts as a preservative or it tends to cover up any undesirable flavor. When kept at 15° C. (59° F.) and especially at 20° C. (68° F.) both the cream and the pimiento cheese became excessively sour in the course of a few days. There was a marked difference in this sour taste in the cheese held at 15° C. (59° F.) and 10° C. (50° F.). Pimiento-cheese held at 5° C. (41° F.) was still edible after six weeks, although some of the surface of the cheese had to be removed.

SUMMARY.

The process of manufacture for Neufchâtel and cream cheese is the same, except as noted. For Neufchâtel use whole milk that tests about 4 per cent; for cream cheese use milk standardized to from 6 to 8 per cent butterfat. Obtain clean, fresh milk.

Pasteurize the milk by heating to 145° F. for 30 minutes and then quickly cool to 80° F. for Neufchâtel and 83° F. for cream cheese.

Add 1 per cent of a freshly made and vigorous lactic-acid starter.

Add either commercial liquid rennet at the rate of one-third of an ounce or five-sixths of a gram of powdered pepsin to each 1,000 pounds of milk for Neufchâtel cheese. For cream cheese use half an ounce of liquid rennet or 1 gram of powdered pepsin for each 1,000 pounds of milk. Either curdling agent should be diluted in half a pail of cold water before being mixed with the milk.

Stir the mixture of milk, starter, and curdling agent and then run it into shotgun cans, 30 pounds in each can, and set away to curdle.

In from 16 to 18 hours pour the contents of each can on cotton sheeting and allow to drain undisturbed for from 2½ to 3 hours. Then work the curd to the center of the cloth, loosen the ends, and make each unit into a bag by folding over the cloth. Place the bags of curd between alternate layers of cracked ice for a few hours or overnight.

Press the curd until each unit (bag) weighs 4½ pounds for Neufchâtel, or 5½ to 6 pounds for cream cheese. This means a yield for Neufchâtel of 15 pounds and for cream cheese of 18 to 20 pounds per 100 pounds of milk, which seems most desirable.

Remove the cakes of curd from the drain cloths and salt at the rate of 1 pound to 100 pounds of curd. Run the curd through a grinding machine, or use a mixing machine and incorporate the salt uniformly.

Pass the curd through a molding machine which shapes the cheese into the desired commercial package. Wrap in tin or aluminum foil and place in special flat boxes.

The homogenization of milk for making cream cheese is not recommended.

The addition of pimiento peppers at the rate of 1 part of peppers to 10 or 20 parts of cream cheese greatly prolongs the keeping quality of the cheese.

Keep the cheese at a temperature of between 40° and 50° F. until consumed.

ADDITIONAL COPIES
OF THIS PUBLICATION MAY BE PROCURED FROM
THE SUPERINTENDENT OF DOCUMENTS
GOVERNMENT PRINTING OFFICE
WASHINGTON, D. C.
AT
5 CENTS PER COPY
△